

PATENT APPLICATION  
Attorney Docket 40217.1US12

We claim:

1. A process for the recovery of sodium bicarbonate from a nahcolite deposit comprising:
  - a. dissolving sodium bicarbonate in a mining zone in the deposit using hot aqueous solution to form a production solution,
  - b. subjecting the production solution to multiple-stages of crystallization to produce crystals of sodium bicarbonate and at least one stream of mother liquor,
  - c. subjecting at least part of the sodium bicarbonate crystals to at least one process selected from the group consisting of dewatering and drying, and
  - d. recycling at least a portion of the mother liquor to the mining zone to dissolve sodium bicarbonate.
2. The process of Claim 1 wherein the majority of the crystallization is conducted at temperatures above the atmospheric boiling point of the solution being processed.
3. The process of Claim 2 wherein the mining zone contains nahcolite and the production solution is a hot aqueous solution containing sodium bicarbonate.
4. The process of Claim 3 wherein the production solution is essentially clear, is essentially free of solids and organics, and contains a minimal amount of salt.

5. The process of Claim 3 wherein the hot aqueous solution containing sodium bicarbonate is obtained from the solution mining of nahcolite with a hot aqueous liquid at a temperature of at least 250°F.

6. The process of Claim 3 wherein the hot aqueous solution containing sodium bicarbonate is obtained from the solution mining of nahcolite with a hot aqueous liquid at a temperature of from 250°F to 550°F.

7. The process of Claim 3 wherein the hot aqueous solution containing sodium bicarbonate is obtained from the solution mining of nahcolite with a hot aqueous liquid at a temperature of from 270°F to 340°F.

8. The process of Claim 3 wherein the hot aqueous solution containing sodium bicarbonate is obtained from the solution mining of nahcolite with a hot aqueous liquid at a pressure of from 150 psig to 700 psig.

9. The process of Claim 5 wherein the hot aqueous solution containing sodium bicarbonate is obtained from the solution mining of nahcolite with a hot aqueous liquid at a pressure of from 150 psig to 700 psig.

10. The process of Claim 6 wherein the hot aqueous solution containing sodium bicarbonate is obtained from the solution mining of nahcolite with a hot aqueous liquid at a pressure of from 150 psig to 700 psig.

11. The process of Claim 7 wherein the hot aqueous solution containing sodium bicarbonate is obtained from the solution mining of nahcolite with a hot aqueous liquid at a pressure of from 150 psig to 700 psig.

12. The process of Claim 3 wherein the hot aqueous solution containing sodium bicarbonate is at a pressure sufficient to prevent the flashing of carbon dioxide.

13. The process of Claim 3 in which the crystallization is not preceded by solids filtration and carbon absorption.

14. The process of Claim 3 wherein the production solution contains between about 12% to 70% sodium bicarbonate.

15. The process of Claim 3 wherein the production solution contains between about 15% to 47% sodium bicarbonate.

16. The process of Claim 3 wherein the production solution contains between about 20% to 35% sodium bicarbonate.

17. The process of Claim 3 wherein the production solution contains between about 0 and 10% sodium carbonate.

18. The process of Claim 3 wherein the production solution contains between about 0 and 5.5% sodium carbonate.

19. The process of Claim 3 wherein the hot aqueous solution containing sodium bicarbonate is obtained from the solution mining of nahcolite with a hot aqueous liquid at a

temperature of at least 250°F and a pressure of from 150 psig to 700 psig, to result in a hot aqueous solution containing between about 12% to 70% sodium bicarbonate, and the crystallization is conducted in 5 or more stages.

20. The process of Claim 3 wherein the pressure of each succeeding stage of crystallization is less than that of the previous stage.

21. The process of Claim 19 wherein the pressure of each succeeding stage of crystallization is less than that of the previous stage.

22. The process of Claim 3 wherein the pressure of at least one stage is maintained above that in equilibrium with the temperature in that stage by the injection of pressurized gas into that stage.

23. The process of Claim 19 wherein the pressure of at least one stage is maintained above that in equilibrium with the temperature in that stage by the injection of pressurized gas into that stage.

24. The process of Claim 22 wherein the gas is carbon dioxide.

25. The process of Claim 23 wherein the gas is carbon dioxide.

26. The process of Claim 3 wherein the mother liquor is heated before being recycled to the mining zone.

27. The process of Claim 26 wherein the mother liquor is heated by interexchange with solution entering at least one of the crystallization stages.

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28. The process of Claim 4 wherein the mother liquor is heated before being recycled to the mining zone.

29. The process of Claim 28 wherein the mother liquor is heated by interexchange with solution entering at least one of the crystallization stages.

30. The process of Claim 19 wherein the mother liquor is heated before being recycled to the mining zone.

31. The process of Claim 30 wherein the mother liquor is heated by interexchange with solution entering at least one of the crystallization stages.

32. The process of Claim 3 wherein supersaturation the crystallization stages is controlled to produce sodium bicarbonate crystals greater than 50 micron.

33. The process of Claim 32 wherein the supersaturation is controlled by cooling.

34. The process of Claim 3 wherein supersaturation the crystallization stages is controlled to produce sodium bicarbonate crystals greater than 100 micron.

35. The process of Claim 34 wherein the supersaturation is controlled by cooling.

36. The process of Claim 3 wherein bicarbonate crystals are removed from each crystallization stage before the bicarbonate containing solution from that stage is passed on to the next crystallization stage.

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37. The process of Claim 3 wherein bicarbonate crystals are removed from one or more of the crystallization stages before the bicarbonate containing solution from that stage is passed on to the next crystallization stage.